

Changing the Way NASA Does Business

The second prong of the National Aeronautics and Space Administration's strategy to adapt to flat future budgets is to spend the funds that the agency receives more efficiently.¹ The proposals for increasing efficiency span a wide range. The agency has proposed relatively small but definite changes in management and procurement practices and policies. Many observers both inside and outside of NASA have suggested more fundamental changes in the agency's approach to the private sector, program management, internal organization, other government agencies, and international cooperation. Finally, other critics have called for revolutionary changes in the institutional charter of the agency, which they view as necessary to create an environment conducive to improved performance.

Many of the suggestions to change the way NASA does business have merit and deserve examination because they offer the prospect of improved performance over the long run. Yet conclusive evidence is lacking that changes in conduct would allow NASA to dramatically reduce the cost of its program. On the one hand, NASA's isolation from the competitive forces that drive efficiencies in the private sector suggests that there is ample room for improvement. On the other hand, experiences to date in reforming NASA and the Department of Defense offer little hope that the right mix of incentives can be created to bring about this improve-

ment. And even if reform ultimately did reduce costs, it would probably take several years of concerted effort to achieve that goal. In the near term, smaller budgets are likely to require more reliance on adjusting the content of NASA's program, be it through reducing the scope of current projects, stretching out their schedules, or canceling them outright. Buying more for less will not allow NASA to escape hard choices if its budget is restricted to slow growth or even reduced.

This study describes specific proposals for change and discusses their potential effects by referring to past experiences of NASA or other public- and private-sector organizations. However, this evaluation of the ongoing effort to "reinvent" NASA is qualitative and incomplete.

Criticizing NASA's Conduct

Critics of the way NASA does business dismiss as superficial the diagnosis that NASA has more program than budget. In their view, the agency's real problem is ineffective management of its resources. Such critics contend that NASA could go forward with its current program without dropping items from its agenda by improving its management and procurement practices, streamlining its operations, and better coordinating its activities with the private sector, other U.S. government agencies, and foreign governments. In short, hard choices would not have to be made between the content of the current program and alternatives. Instead, NASA could aggressively pursue its piloted spaceflight and space science agendas and at the same time increase its spending on technology useful to industry.

1. National Performance Review, *National Aeronautics and Space Administration*, accompanying report to *From Red Tape to Results: Creating a Government That Works Better and Costs Less* (released February 1994), includes many of the suggestions that are included in this chapter. The Congressional Budget Office's evaluation of these issues was completed before the release of the National Performance Review report.

NASA was once perceived as a model government agency.² The successful Moon landings it carried out were heralded as a demonstration of managerial efficiency and innovation in the public sector. Thus, the current characterization of NASA in some quarters as a poorly managed agency that is immobilized by external and internal forces is all the more striking. For NASA's critics, the agency's difficulties, ranging from underestimating project costs to the Challenger accident to the recent problem with the Mars Observer, are directly related to the way the agency conducts its business. Specifically, critics place a large part of the blame for these failures on poor planning and contract management and careless acquisition and procurement practices.

The criticism of NASA's institutional character is sometimes so sweeping as to leave no apparent option but to dissolve the agency and start anew. In an extreme negative caricature, NASA is portrayed as an agency run by risk-averse managers who seek to maximize stability and budget growth at the expense of efficiently achieving program goals. Large programs that go on indefinitely and major NASA installations run as independent city-states are the result. This harsh view of the agency maintains that supporters of the program value it largely as a dispenser of local economic benefits--contracts and jobs--rather than as a key part of the nation's science and technology effort. Private contractors respond to NASA management practices by deliberately underbidding contracts, overrunning costs, and delivering unsatisfactory products. There is little incentive for any of the actors in the system to change their ways.

Of course, this extremely negative portrayal of NASA's conduct ignores the agency's strengths and successes by emphasizing only its failings and problems. Nevertheless, even the remotest resemblance of the agency to this unflattering picture raises general questions about the way NASA conducts its

activities and specific questions about its management, procurement, and acquisition practices.

Management, Procurement, and Acquisition

Criticisms have been aimed at NASA from two different perspectives. One point of view sees the agency's problems as caused by too much regulation and bureaucracy. The other sees them as rooted in a failure to conform to procurement law and to operate as an efficient bureaucracy.

The position that sees NASA as having too much bureaucracy builds on an analysis of the agency's evolution as an organization and its interactions with a changing legal and institutional environment. In this view, procurement laws that are designed to ensure fairness and protect taxpayers from fraud decrease efficiency by increasing reporting requirements and preventing program managers from adopting cost-saving innovations that may appear. Reporting requirements in particular are seen as a problem because they increase as organizational aging leads to more bureaucratic layers and as a larger number of constituents in both the Congress and the executive branch demand accountability. Answering this critique points toward policy changes that free NASA from some aspects of procurement regulation. One such change--the Mid-Range Procurement Initiative--that the agency is seeking would diminish administrative burdens and expedite procurement. Another change would allow NASA to pursue some projects outside of normal procurement practices through independent program offices. This approach would invest program managers with substantial authority and discretion to accomplish their projects but at the same time hold them accountable for results. Tests undertaken as part of the Strategic Defense Initiative are sometimes suggested as models for this independent program office approach.

A large number of the audits of NASA projects and programs undertaken by the General Accounting Office criticize the agency's conduct of its program from a different point of view. A pamphlet prepared to support the transition to the Clinton

2. The testimony of John Pike, director of the Space Policy Project, Federation of American Scientists, before the Subcommittee on Legislation and National Security, House Committee on Government Operations, October 6, 1993, pp. 3-4, discusses this perception but concludes that NASA has always had major problems in the way it does business.

Administration summarized previous reports and emphasized NASA's failure to conform to procurement laws and its lack of bureaucratic rigor as causes of the agency's problems with performance.³ Among the particulars offered by GAO were NASA's failure to oversee technical activities by contractors, its acceptance of unauthorized change orders, and the failure to impose uniform test standards across the agency's centers and programs. The solution implied by these criticisms is better bureaucracy supported by standardized, reliable information. Along those lines, GAO noted that during the 1980s, the dollar volume of NASA contracts as well as their absolute number grew by around 50 percent, although the number of procurement personnel increased by only 20 percent.

Institutional Character

NASA's organizational history is relevant to the criticism of its current conduct. A recent scholarly analysis traces the evolution of NASA as an organization from its beginnings as a combination of existing governmental research groups to the present day.⁴ That approach reveals the origins of some current problems and suggests how difficult it will be to change the way NASA does business.

NASA's original organizational culture was dominated by engineers and scientists who valued research, testing, and verification and created an organization that had the in-house capability to implement those processes. The young NASA was a dynamic organization supported by growing budgets and freed from the normal constraints of government by a mandate to execute a crash program. In this environment, a detailed, centralized style of program management coexisted profitably with an organizational ethic of technical discretion and dissent.

Yet the factors that contributed to the success of the young NASA also began to undermine its cul-

ture. For example, the Apollo program brought large increases in the agency's budget but forced NASA to replace the ethic of "building it in-house" with contracting out work to private industry. The agency sought to retain tight control and its own technical capabilities, however, by "penetrating" the contractor--specifying what would be done and how it would be accomplished and closely monitoring production. According to some observers, this approach prevented NASA's contractors from accomplishing their work efficiently and ultimately proved to be so ineffective in maintaining the technical capacity of the agency that NASA is no longer considered an intelligent buyer.⁵ In a similar way, the major NASA centers grew during the Apollo years but diminished the strength of centralized control by acquiring local political and economic significance that was to complicate later program decisions.

Management Reform

In early 1993, NASA announced a set of initiatives to improve management and procurement at the agency.⁶ They represent the agency's latest response to the criticism of its practices. NASA's package of management reforms includes seven items:

- o Improving planning by directing more funding and attention to the earliest phases of a project;
- o Creating program commitment agreements between the NASA administrator and associate administrators to define program objectives, identify technical risks, commit resources, and specify technical and schedule milestones;
- o Establishing a Program Management Council that regularly reviews program progress, medi-

3. General Accounting Office, *NASA Management* (January 1993).

4. This discussion draws heavily on Howard E. McCurdy, *Inside NASA: High Technology and Organizational Change in the U.S. Space Program* (Baltimore, Md.: Johns Hopkins University Press, 1993), pp. 159-174.

5. Testimony of Robert Frosch, Senior Research Fellow, John F. Kennedy School of Government, Harvard University, before the Subcommittee on Science, Technology, and Space, Senate Committee on Commerce, Science, and Transportation, November 16, 1993, p. 4.

6. National Aeronautics and Space Administration, *NASA Management and Procurement Reforms* (April 1993); and National Performance Review, *National Aeronautics and Space Administration*, pp. 19-24.

ates between the agency's overall budget constraints and its programs, and fixes or even cancels programs that are experiencing problems with costs, schedules, or technical performance;

- o Setting up a mission review process that assesses the progress of spaceflight projects two years and again one year prior to launch;
- o Creating an independent capacity for cost estimating in the Office of the Comptroller;
- o Improving reporting by contractors to provide senior management with sufficient data to evaluate performance; and
- o Developing measures of contractor performance to support oversight by NASA management and to include past contractor performance as an award criterion in selecting new projects.

If the agency's management practices are to improve, the commitment to improvement by senior managers and the political system is probably more important than the specific management approach. For example, improved project planning amounts to a more expensive early development phase for most projects. That kind of process would allow a better preliminary design and more accurate assessment of technical, cost, and schedule risks. The idea is a perennial favorite and is prominently noted, for example, in a 1980 NASA study of project management to support the transition from the Carter to the Reagan Administration.⁷ The difficulty lies in carrying out the process and in protecting such funds from reductions in tight budgetary times. The point applies to the proposed program commitment agreement as well: tight budgets can cause commitments to be broken.

Both the proposed Program Management Council and the mission review process raise the question of adding layers of review and management to a system already viewed by critics as too bureaucratic. Unless other review levels are eliminated, such additions are inconsistent with the goal of streamlining

NASA's process for procurement and acquisition. Center-level review processes are candidates for elimination because the general drift of the management package is toward more authority and accountability at the program level with oversight shifted to a centralized management authority at the headquarters level.

The management reform initiative to improve "independent cost estimating" implies more than simply reviewing methods and adding personnel. At the heart of the matter is the question of independence from whom or what. The 1990 Augustine report suggests the importance of independence from "overselling on the part of program advocates, both in government and industry."⁸ The most radical proposals call for the largest NASA programs to be comanaged by an intra-agency group—for example, the National Space Council. The essence of these suggestions is that "overselling" occurs at the agency as well as at the program level and that truth in estimating costs will require a counterbalance to the authority of NASA's most senior management.

An example of this phenomenon can be found in one version of how the early estimate of \$8 billion for the cost of the space station evolved. According to a scholarly analysis by Howard McCurdy, at the time that the idea for the station was being "sold," the formal process of cost estimating within the agency pointed toward a figure higher than \$8 billion.⁹ (The \$8 billion estimate

7. Howard McCurdy, *The Space Station Decision: Incremental Politics and Technological Choice* (Baltimore, Md.: Johns Hopkins University Press, 1990), p. 85.

8. National Aeronautics and Space Administration, *Report of the Advisory Committee on the Future of the U.S. Space Program* (December 1990), p. 37. For similar points, see National Academy of Public Administration, *Program Control in NASA: Needs and Opportunities* (Washington, D.C.: National Academy of Public Administration, 1989), pp. 14-15. This study, which is based on the results of an extensive survey of NASA and industry program managers, reports that "the contractor's negotiated bid generally becomes the baseline . . . this is true even though the contractor's estimate is usually considerably lower than the government's estimate. The rationale for the government's higher estimate is in most cases quickly forgotten. Credibility begins to be attached to the contractor's estimate which is not justified or borne out by history."

9. See McCurdy, *The Space Station Decision*, pp. 175 and 230-233. The author discusses the initial \$8 billion estimate for the space station and concludes that the number was ultimately a political device to sell the program rather than a cost estimate of a well-defined project. NASA's professional cost estimators, according to McCurdy, were well aware that the estimate put forward by the agency's leadership was not realistic.

was the extreme low end of a range of estimates and excluded significant costs of the project.) According to McCurdy, the highest level of authority within the agency chose to put forward a more politically appealing lower estimate. Neither improving the quality of cost estimates at the program level nor seeking independent assessments is likely to result in the Congress's receiving better cost estimates, unless the agency's senior managers are committed to providing them.

If NASA can carry out its management reforms, it could reduce the cost of the space program in the future. But projects in the current budget have already been planned and are under contract. If the projects have been carefully designed and their costs accurately estimated, they will not fall victim to the cycle of shifting requirements, technical surprises, and contract changes that have characterized some programs in the past. If not, it is too late for NASA's current round of management reforms to help them.

Procurement Reforms

Among a larger set of offerings, NASA proposes three major changes in procurement:

- o Modifying the agency's incentive contracting procedures to standardize them among the various NASA centers and make contractors more responsible for their performance by using types of contracts that allow the government to recover award fees when finished systems fail to perform;
- o Streamlining "midrange" procurement (contracts between \$25,000 and \$500,000) to diminish administrative burdens and expedite the procurement process; and
- o Assigning substantial weight to past contractor performance in awarding new contracts so as to place firms that have performed badly in the past at a disadvantage in bidding for new projects.

The direction of NASA's procurement reforms evident in these proposals and in complementary procurement and management initiatives is to create an efficient, standardized process within the agency. Such a process would better define the responsibilities of the government and the contractor and allow the agency to hold contractors accountable for their performance.

Incentive Contracting

The current dissatisfaction with NASA's performance—for example, the problems with the Hubble Space Telescope—has led to a mandated review of the agency's contracting practices.¹⁰ Currently, over 75 percent of NASA's procurement dollars are spent under cost-plus-award-fee contracts (see Box 3). The appropriateness of this form of contract is being questioned, particularly for purchases that do not involve extraordinary technical risk and that might be made on more conventional commercial terms. Even in circumstances in which cost-plus contracting is appropriate, NASA's current incentive contracting practices have been criticized as relying too heavily on interim awards that cannot be adjusted even if the final product is unsatisfactory.¹¹ In addition, a perception exists that contracting and procurement rules are unevenly and loosely enforced and that award criteria vary across centers.

NASA proposes to tighten the contracting process overall, to evaluate contract performance more on the basis of end results than on interim goals, and to change fee policies to allow penalties for unsatisfactory performance.¹² The agency would create a hybrid contract type that used award fees as

10. The Schumer Amendment to the National Aeronautics and Space Administration Authorization Act for Fiscal Year 1993 directs the agency to review its contracting procedures, specifically those that allocate risk to the government and the contractor.

11. Data for 1992 and 1993 that NASA provided to the Congressional Budget Office in a letter dated August 18, 1993, show an average award score of 88.5 percent and an average award of 87.5 percent of possible fees.

12. National Performance Review, *National Aeronautics and Space Administration*, pp. 6-8.

Box 3.
**A Brief History of the National Aeronautics
 and Space Administration's Contract Preferences**

The National Aeronautics and Space Administration's (NASA's) mission emphasizes the development of systems that require technical innovation. The private sector cannot be expected to bear the risk of cost overruns when technologies of the type that NASA has historically purchased are first being brought into use. Accordingly, the agency has long preferred so-called cost-plus contracts that share the risk of unforeseen problems between the government and its contractors.¹

Cost-plus contracts permit the government to cover the cost of unforeseen problems. Without such arrangements, private firms might be unwilling to take the risk of developing new spacecraft or other similar projects. In its earliest years, NASA combined the cost-plus feature with fixed fees that gave contractors only limited incentives to control

costs and meet technical and schedule goals (see the table below).

In the 1960s, both NASA and the Department of Defense adopted the practice of awarding incentive fees at the completion of contracts to encourage better performance. Under this type of arrangement, the fee a contractor received on a particular contract was tied to meeting cost control goals--the incentive to control costs was the promise of higher fees. When cost goals were not met, the contractor's fee was reduced through a formula that divided the overrun between the government and the contractor.

The 1967 fire that occurred during a test of the Apollo capsule brought demands for tighter supervision of contractors. Cost-plus-award-fee (CPAF) contracts that required more frequent evaluations of a contractor's progress and tied fees to goals other than cost control became the dominant contract type until the mid-1980s, when cost-plus-incentive-fee arrangements and even fixed-price contracts came into wider use. The Challenger accident triggered a response similar to that after the Apollo fire: a return to the CPAF contract to insure direct agency involvement in quality and safety assurance.

1. Alexander R. Love, Chairman, Development Assistance Committee, *Development Cooperation* (Paris: Organization for Economic Cooperation and Development, 1992), pp. 112-115, A-8, A-23, and A-24.

**Share of Net Value of Procurement Awards by the National Aeronautics and Space
 Administration, by Contract Type, Selected Fiscal Years (In percent)**

Contract Type	1961	1965	1970	1975	1980	1985	1991
Firm Fixed Price	16	12	12	15	12	13	10
Cost Plus Fixed Fee	83	71	42	14	12	9	8
Incentive Fee	n.a.	16	46	69	72	16	3
Cost Plus Award Fee	n.a.	a	a	a	a	56	76
Other	1	1	0	2	4	6	3

SOURCE: Congressional Budget Office based on the National Aeronautics and Space Administration, *Annual Procurement Report* (various years).

NOTE: n.a. = not applicable.

a. Data on incentive fees include both incentive and award fee contracts.

incentives for interim progress but held back a final incentive payment against a last evaluation of a system's performance. The final evaluation process could result in a negative incentive fee and the contractor's returning part of the interim awards to the government. This penalty could be invoked in cases in which performance of the system is ultimately less than satisfactory and the contractor's performance can be identified as a cause.

Formal evaluations of the Department of Defense's (DoD's) use of incentive contracting--either the award fee or incentive fee type--suggest that incentives are positively associated with less growth in the costs for developing strategic missile systems and satellites.¹³ The extent to which changing the mix of incentives between interim awards and final performance awards improves project outcomes has not been formally evaluated for either DoD or NASA. As with management reform, gains in efficiency and lower costs from improving NASA's incentive contracting are more likely for new projects than for those already in process.¹⁴

The Mid-Range Procurement Initiative

The second major procurement reform being proposed by NASA is called the Mid-Range Procurement Procedure. This proposal would streamline the process that NASA uses to buy goods and services valued at \$25,000 to \$500,000 by permitting it to use procedures similar to those it currently uses for smaller purchases. NASA has received approval from the Office of Federal Procurement Policy to undertake the effort as a pilot test. The objective of the project--less complicated procurement procedures--is conceptually similar to proposals that would allow the agency to buy much more expen-

sive and technically challenging goods and services on commercial terms.

According to NASA's Office of Procurement, only 13 percent of NASA's 1992 procurement funding was spent under contracts covered by the Mid-Range Procurement Initiative. Thus, even an extremely successful reform effort that reduced costs by 5 percent would save only about \$85 million annually. The initiative might yield additional savings by decreasing the number of NASA employees working in procurement. However, increasing productivity in procurement activities is more likely to allow the agency to make do with a smaller increase in such personnel than was recently recommended by examiners from both the executive branch and the Congress.¹⁵

Contractor Performance

A third significant change in procurement that NASA proposes is to take into account past performance by contractors in evaluating bids for new contracts. For example, a contractor that consistently underbid work in the past would lose evaluation points in the agency's assessment of any bid for new work. NASA is developing a set of measures of contractor performance to put this system into operation. The agency's evaluation of a major contractor's performance would be transmitted periodically to the contractor's most senior management.

A New Relationship with the Private Sector

A broad range of suggestions to change the way NASA does business would place more responsibility for final performance on contractors and rely less on NASA's monitoring of them to assure qual-

13. Karen Tyson and others, *Acquiring Major Systems: Cost and Schedule Trends and Acquisition Effectiveness* (Alexandria, Va.: Institute for Defense Analysis, March 1989), p. XI-3.

14. Charles W. Polk, "Contracting from Private Firms for Planetary Mission Subsystems" (discussion paper, California Institute of Technology, January 1994), illustrates a second point: the current set of proposals to reform NASA's contracting practices are neither the only nor the most innovative suggestions.

15. National Aeronautics and Space Administration, Office of Procurement, "Procurement Organization Metrics," letter to the Congressional Budget Office, October 16, 1992; and General Accounting Office, *NASA Contract Management* (December 1992), p. 29.

ity and safety.¹⁶ The incentive contract reform discussed earlier is one move in that direction. A more aggressive action is to fully implement the buy-commercial provision of the Bush Administration's space policy.¹⁷ That policy directed NASA, when feasible, to purchase data and services from the private sector rather than designing, developing, and operating its own hardware to provide similar products.

The various relationships between NASA and the private sector fall along a continuum. At one extreme is NASA's traditional mode of acquisition, which involves the government directly in the design, development, production, launch, and subsequent operation of a spacecraft that produces a data product or service. At the other extreme is the commercial purchase of those same data or services without government oversight of the nuts and bolts of spacecraft design, production, and operation. Between these extremes are contracts that permit the use of standard commercial components in NASA's spacecraft, that specify a system's final performance rather than design requirements, or that deliver a spacecraft in orbit to the agency.

The vision that underlies suggestions to buy more on commercial terms emphasizes two points. First, the aerospace industry can produce the technically sophisticated products that NASA needs more cheaply without government supervision than with that oversight. The traditional mode of procurement forces contractors to maintain separate systems for production and financial control and to use government-approved components. If NASA bought more on commercial terms, it could lower its costs because contractors could integrate their government business with their commercial production lines and accounting systems and could substitute less expen-

sive commercial components for more expensive ones manufactured to government specifications.

There are many cases of higher prices being paid for the same good when purchased through the traditional mode of government procurement rather than commercially. For example, the cesium atomic clock, used in both government spacecraft and Earth-bound commercial navigation and communications systems, reportedly cost 12 times more when purchased through the traditional mode of procurement for government spacecraft than when purchased commercially for use on Earth.¹⁸ The analysis attributed only a two-to-one difference in price to the rigors of use in space, leaving a six-to-one difference attributable to the government's way of doing business.

A 1993 study by the Defense Science Board used a small number of similar cases and expert opinion to develop rules of thumb for estimating savings. The board estimated that various changes in the conduct of government procurement--significant among them, purchasing on commercial terms--could reduce the cost of defense acquisitions by as much as 20 percent.¹⁹ The study concluded, however, that this level of savings was likely only after five years of determined reform. The best judgment of the study board notwithstanding, questions can be raised about how much confidence could be placed in the study's conclusions, given that they were based on a small number of cases rather than on a large sample survey.

Among the candidates for purchases on commercial terms are NASA's communications satellites or the services they provide. Some of the data needed for global climate research, which are now provided by hardware that the government designed,

16. Congressional Budget Office, *Encouraging Private Investment in Space Activities* (February 1991), considers buy-commercial policies from the perspective of encouraging new private investment. The discussion above is principally concerned with buying from the private sector as a policy for lowering the cost and improving the performance of civilian space activities. The accompanying report to the National Performance Review dealing with NASA (pp. 5-7) includes the suggestion to buy data on commercial terms under the broader umbrella phrase of "performance-based contracting strategies."

17. National Space Council, *Final Report to the President on the U.S. Space Program* (January 1993), pp. III-19 through III-22.

18. Helmut Hellwig, "Cost Comparison Between the Space Flight and the Commercial Catalog Models of a Cesium Atomic Clock Module," in National Institute of Standards and Technology, *Reducing the Cost of Space Infrastructure and Operations*, part 2, *Topical Papers*, William C. Stone, ed. (August 1993), pp. 135-144.

19. Defense Science Board, *Report of the Defense Science Board Task Force on Defense Acquisition Reform* (Office of the Under Secretary of Defense for Acquisitions, July 1993), pp. C-1 through C-10. Savings for NASA could be considerably less than the 20 percent savings for DoD because NASA projects often require purchasing only one item, whereas defense procurement includes many multiunit purchases.

developed, and operates, are another frequently suggested candidate. An innovative program to give scientists vouchers for purchasing launch services for small scientific payloads on the commercial market rather than waiting for a government-provided launch is consistent with commercial purchasing.

Purchasing on commercial terms, however, is not a panacea for NASA's procurement problems. For example, when the government is the sole customer for a spacecraft or for the data it produces, the potential savings from commercial purchasing may be offset by the higher price that the government must pay for private financing and the cost of private insurance.²⁰ In a recent extreme case, the cost to NASA of services procured on commercial terms included the cost of insurance for the providers against the possibility that the government might fail to appropriate sufficient funds to allow NASA to meet its purchasing commitment.²¹

Risk is also an issue. Spacecraft that require advanced technology may ultimately perform better and cost the government less when procured in the traditional mode, which recognizes the uncertainties of cost estimates and applies the expertise of both NASA and its contractors in solving technical problems. One of the few general lessons from years of government acquisition of systems requiring new technology is that fixed-price contracting--an essential element of commercial purchases--is not appropriate for such systems.

Systems used for piloted spaceflight raise the issue of accountability. The public holds NASA directly accountable for the risk of loss of human

life in spaceflight, implying a significant degree of oversight by NASA personnel in the design and development of hardware used in programs involving such activities. Each time lives have been lost in the U.S. space program, NASA's relations with its contractors have moved away from commercial terms and toward direct supervision. For example, in the wake of the Challenger accident, the Rogers Commission recommended that both NASA and its contractors maintain a high level of technical engineering skills because the shuttle program was likely to be always in a developmental phase.²² The prevalence of piloted activity in the current program and its large share of the budget may impose a limit on the agency's commercial purchases and the potential of this type of reform to reduce costs.

A final drawback to wider adoption of commercial purchasing is its potential effect on NASA's ability to be an intelligent customer. The National Academy of Public Administration's 1991 study addressed this issue and concluded that the breadth of the current program and the personnel hours necessary to support award fee contracting were compromising the agency's ability to be a "smart buyer" because NASA personnel were increasingly cast in a hands-off role.²³ Transferring more responsibility to the private sector could further decrease NASA's in-house technical capacity.

Streamlining

The picture critics paint of NASA as an organization choking on its own procedural complexities underlies calls to streamline the agency's acquisition and management system. Advocates of streamlining see two necessary tasks: freeing NASA from excessive regulations for procurement and acquisitions and diminishing the role of NASA's field centers in program management.

20. For a discussion of these issues and several others concerning the budgetary treatment of commercial purchases and their relationship to lease-purchase agreements, see Congressional Budget Office, "Preliminary Analysis of NASA Commercialization Initiatives," CBO Staff Memorandum (February 1989), p. 7. The accompanying report to the National Performance Review dealing with NASA (p. 8) raises a second and related issue concerning the government's liability for termination costs should it choose to withdraw from a commercial purchase agreement.

21. National Aeronautics and Space Administration, "Analysis of NASA Lease and Purchase Alternatives for the Commercial Middeck Augmentation Module" (prepared by Price Waterhouse, the Center for Space and Advanced Technology, and Marsh & McLennan, June 6, 1991), Appendix C.

22. National Aeronautics and Space Administration, *Report of the Presidential Commission on the Space Shuttle Challenger Accident* (1986), pp. 194-195.

23. National Academy of Public Administration, *Maintaining the Program Balance* (Washington, D.C.: National Academy of Public Administration, 1991).